

10/018376

TRANSMITTAL LETTER TO THE UNITED STATES  
ELECTED OFFICE (EO/US)  
(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II PCT)

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PCT/IT99/00173

International Filing Date:  
16 June 1999

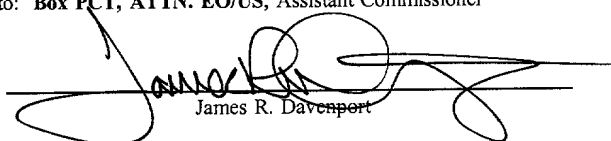
Priority Date Claimed:  
16 June 1999

Title of Invention: **PLANT FOR WASHING PLASTIC MATERIAL**

Applicant: Piergiorgio Teruggi et al.

**CERTIFICATION UNDER 37 C.F.R. § 1.10**

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the U.S. Postal Service on this date **December 13, 2001** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EV001611304US addressed to: **Box PCT, ATTN. EO/US, Assistant Commissioner For Patents, Washington, D.C. 20231.**

  
James R. Davenport

**BOX PCT**

Assistant Commissioner For Patents  
Washington, D.C. 20231  
ATTN: EO/US

1. a. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.  
b. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
2. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:  
a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. 371(f).  
b. ☒ The U.S. National Fee (35 U.S.C. 371(c)(1) and other fees (37 CFR 1.492) as indicated below:
3. Fees  
a. **BASIC NATIONAL FEE**  
☒ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY  
Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO:  

<input type="checkbox"/> has been paid (37 CFR 1.492(a)(2))	740.00
<input type="checkbox"/> has not been paid (37 CFR 1.492(a)(3))	1040.00
<input checked="" type="checkbox"/> where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5))	890.00
- b. **EXTRA CLAIM FEE**

**CLAIMS AS FILED**

Number Filed	Number Extra	Rate	Basic Fee - \$890.00 (37 C.F.R. § 1.492(a)(5))
Total Claims (37 C.F.R. § 1.16(c))	22 - 20 =	2 × \$18.00 =	\$36.00
Independent Claims (37 C.F.R. § 1.16(b))	2 - 3 =	0 × \$84.00 =	\$0.00
Multiple Dependent Claim(s), if any (37 C.F.R. § 1.16(d))	+ \$270.00 =		\$0.00

- c. **SMALL ENTITY:** Applicant qualifies for and hereby claims Small Entity Status

Total National Fee	<u>\$926</u>
Small Entity Status - 50% reduction	\$463
Assignment Recordation fee	\$40
Total Fees Enclosed	\$503

☒ Check in the amount of **\$503.00** to cover the above fees is enclosed.

10/018376

1919 Rec'd PCT/PTO 13 DEC 2001

4. A copy of the International application as published (35 U.S.C. 371(c)(2)):

- a. ☒ is transmitted herewith.  
b. ☐ is not required, as the application was filed with the United States Receiving Office.  
c. ☒ has been transmitted  
i. ☒ by the International Bureau.  
Date of mailing of the application (from form PCT/IB/308) 21 December 2000  
ii. ☐ by applicant on (date) \_\_\_\_\_.

5. A Translation of the International application into the English language (35 U.S.C. 371(c)(2)):

- a. ☐ is transmitted herewith.  
b. ☒ is not required as the application was filed in English.  
c. ☐ was previously transmitted by applicant on (date) \_\_\_\_\_.  
d. ☐ will follow.

6. Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

- a. ☒ are transmitted herewith (as a part of the International Examination Report)  
b. ☐ have been transmitted  
i. ☐ by the International Bureau.  
Date of mailing of the amendment (from form PCT/IB/308): \_\_\_\_\_  
ii. ☐ by applicant on (date) \_\_\_\_\_.  
c. ☐ have not been transmitted as  
i. ☐ applicant chose not to make amendments under PCT Article 19. Date of mailing of Search Report (from form PCT/ISA/210) \_\_\_\_\_  
ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

7. A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)):

- a. ☐ is transmitted herewith.  
b. ☒ is not required as the amendments were made in the English language.  
c. ☐ has not been transmitted for reasons indicated at point 5c above.

8. A copy of the international examination report (PCT/IPEA/409)

- ☒ is transmitted herewith.  
☐ is not required as the application was filed with the United States Receiving Office.

9. Annex(es) to the international preliminary examination report

- a. ☒ is/are transmitted herewith.  
b. ☐ is/are not required as the application was filed with the United States Receiving Office.

10. A translation of the annexes to the international preliminary examination report

- a. ☐ is transmitted herewith.  
b. ☒ is not required as the annexes are in the English language.

11. An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115

- a. ☐ was previously submitted by applicant on (date) \_\_\_\_\_.  
b. ☒ is submitted herewith

II. Other document(s) or information included:

12. An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

- a. ☒ is transmitted herewith.  
b. ☐ has been transmitted by the International Bureau. Date of mailing (from form PCT/IB/308): \_\_\_\_\_  
c. ☐ is not required, as the application was searched by the United States International Searching Authority.  
d. ☐ will be transmitted promptly upon request.  
e. ☐ has been submitted by applicant on (date) \_\_\_\_\_

10/018376

JC13 Rec'd PCT/PTO 13 DEC 2001

13. An Information Disclosure Statement under 37 CFR 1.97 and 1.98:

- a. ☐ is transmitted herewith.  
     ☐ Also transmitted herewith is/are:  
     ☐ Form PTO-1449.  
     ☐ Copies of citations listed.
- b. ☒ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).
- c. ☐ was previously submitted by applicant on (date) \_\_\_\_\_.

14. An Assignment document:

- a. ☐ will follow
- b. ☒ is transmitted herewith for recording.  
     A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or FORM PTO 1595 is also attached.

15. Additional Documents

- a. ☒ Copy of Request (PCT/RO/101)
- b. ☐ International Publication No. \_\_\_\_\_
- i. ☐ Specification, claims and drawing
- ii. ☐ Front page only.
- c. ☒ Preliminary amendment (37 CFR § 1.121)
- d. ☒ Other: Power of Attorney by Assignee Amut S.p.A.

16. The above checked items are being transmitted

- a. ☒ before 30 months from any claimed priority date.
- b. ☐ after 30 months.

17. Authorization To Charge Additional Fees and Credit Overpayment

- ☒ The Commissioner is hereby authorized to charge payment of any additional fees that may be required by this paper including, without limitation, filing fees, fees for presentation of extra claims, and surcharge for filing late declarations to Deposit Account No.: 08-1290.  
     An originally executed duplicate of this transmittal is enclosed for this purpose.

18. Return Receipt Postcard

- ☒ Enclosed.

Dated December 13, 2001



Virginia S. Medlen  
 Registration No.: 32,050

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Piergiorgio Teruggi et al.

Serial No.:

Group No.:

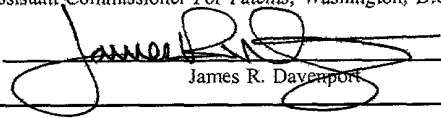
Filed:

Examiner:

Entitled:

**PLANT FOR WASHING PLASTIC  
MATERIAL****PRELIMINARY AMENDMENT**Assistant Commissioner for Patents  
Washington, D.C. 20231**CERTIFICATION UNDER 37 C.F.R. § 1.10**

I hereby certify that this Preliminary Amendment is being deposited with the U.S. Postal Service on this date **December 13, 2001** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number **EV001611304US** addressed to: **Box PCT, ATTN. EO/US, Assistant Commissioner For Patents, Washington, D.C. 20231.**

  
 James R. Davenport

Sir:

**PRELIMINARY AMENDMENT**

In order to place this national entry application in condition to begin prosecution, please amend the prior PCT application Serial No. PCT/IT99/00173 filed on 16 June 1999 as follows:

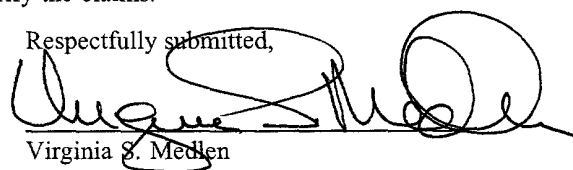
**IN THE CLAIMS**

Please amend claims 1-22 as shown in the marked-up version attached as Appendix 1 pursuant to 37 C.F.R. §1.121, by deleting the material enclosed within square brackets and inserting the material which is underlined. A clean version of the rewritten, added, and/or cancelled text of the claims is included as Appendix 2 pursuant to 37 C.F.R. §1.121.

**REMARKS**

Applicant respectfully requests entry of the above preliminary amendment. Claims 1-22 have been amended to remove multiple dependency language, and to clarify the claims.

Respectfully submitted,

  
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APPENDIX 1  
MARKED-UP VERSION OF AMENDED CLAIMS (37 CFR 1.121)

1. (Once Amended) A plant for the continuous washing of plastic material in scales, of the type comprising a washing apparatus [(1)] equipped with at least one rotating stirrer [(2)] and containing a washing fluid, at least one filtering unit [(50)] connected to said apparatus for purifying said washing fluid, a device [(5)] for feeding said scales to said washing apparatus [(1)], a device for withdrawing said scales from said washing apparatus and a plurality of conduits to connect in fluid communication said washing apparatus [(1)] and said filtering unit [(50)] with a circuit in which said washing fluid flows, [characterized by comprising means (20, 6, 36)] including means for varying the time said scales remain in said washing apparatus [(1)] as a function of the quantity of scales contained at the same moment in said washing apparatus.
2. (Once Amended) A plant according to Claim 1, [characterized in that] wherein said rotating stirrer [(2)], said device [(5)] for feeding said scales and said device [(35)] for withdrawing said scales are operated by respective electric motors [(6, 36)].
3. (Once Amended) A plant according to Claim 1 [or 2, characterized in that] wherein said means for varying the time said scales remain in said washing apparatus [(1)] comprises at least one first control device [(20)] acting to receive as input a data item representative of the current drawn by the motor [(3)] driving said stirrer [(2)] and to control the driving of said motors [(6, 36)] connected respectively to said device [(5)] for feeding said scales and to said device [(35)] for withdrawing said scales.
4. (Once Amended) A plant according to Claim 1, [characterized by] additionally comprising at least one second control unit for varying the speed of rotation of said stirrer [(2)] as a function of the quantity of scales contained in said washing apparatus [(1)].

5. (Once Amended) A plant according to Claim 1 [any of the preceding Claims, characterized in that] wherein said washing apparatus [(1)] comprises a closed container [(10)] and is surrounded by a heat-insulating covering shell [(11)] to form a gap [(12)] between [the] an inside wall of said shell [(11)] and [the] an external wall of said container [(10)].
6. (Once Amended) A plant according to Claim 5, [characterized by] additionally comprising means for making a heating fluid to circulate in said gap.
7. (Once Amended) A plant according to Claim 1 [any of the preceding Claims, characterized in that] wherein said washing fluid consists of an aqueous solution.
8. (Once Amended) A plant according to Claim 1 [any of the preceding Claims, characterized by] additionally comprising a conduit of readmission [(94)] that carries at least one fraction of the washing fluid purified by said at least one filtering unit [(50)] to said device [(35)] for withdrawing said scales from said washing apparatus [(1)], the remaining fraction of said fluid being reintroduced directly into said washing apparatus [(1)].
9. (Once Amended) A plant according to Claim 8, [characterized by] additionally comprising at least one heat exchanger device [(17)] located along said conduit of readmission [(16, 19, 91, 93, 94)] to control the temperature of said washing fluid by means of a heating fluid.
10. (Once Amended) A plant according to Claim 8, [characterized by] additionally comprising at least one device [(100)] located along said conduit of readmission [(16, 19, 91, 93, 94)] for monitoring the pH of said washing fluid.
11. (Once Amended) A plant according to Claim 8, [characterized by] additionally comprising at least one station [(110)] located along said conduit of readmission [(16, 19, 91, 93, 94)] for adding one or more chemical products to the aqueous solution that constitutes said washing fluid.

12. (Once Amended) A plant according to Claim 6 [or 9, characterized in that] wherein said heating fluid introduced into said gap [(12)] and in said heat exchanger device [(17)] consists of high temperature steam.
13. (Once Amended) A plant according to Claim 1 [any of the preceding Claims, characterized in that] wherein said at least one filtering unit [(50)] comprises at least one fine-pore filtering element [(51)].
14. (Once Amended) Method for washing plastic material in scales, of the type providing the feeding and the withdrawing of said scales in a continuous way to a washing apparatus [(1)] equipped with at least one rotating stirrer [(2)] and containing a washing fluid, characterized by providing the regulation of the time said scales remain in said washing apparatus [(1)] as a function of the quantity of scales contained at that same moment in said washing apparatus [(1)].
15. (Once Amended) A method according to Claim 14, characterized in that the time said scales remain in said apparatus is regulated by acting on the quantity of scales fed to said washing apparatus [(1)] and on the quantity of scales withdrawn from said washing apparatus [(1)].
16. (Once Amended) A method according to Claim 14, characterized by further providing the regulation of the speed of rotation of said stirrer [(2)] as a function of the quantity of scales contained at that same moment in said washing apparatus.
17. (Once Amended) A method according to Claim 14, characterized in that said washing apparatus [(1)] comprises a substantially closed container [(11)] in which said washing fluid and said scales are maintained at a substantially constant temperature by means of a heating fluid that circulates in contact with [the] an external surface of said container.
18. (Once Amended) A method according to Claim 14, characterized by providing for the purification of said washing fluid by means of a filtering unit [(50)] comprising at least one fine-pore filtering element [(51)].

19. (Once Amended) A method according to Claim 14, characterized by providing for the control of the temperature of said washing fluid leaving said filtering unit [(50)] before its readmission into said washing apparatus [(1)].

20. (Once Amended) A method according to Claim 14, characterized by providing for the control of the pH of said washing fluid and the addition of chemical mixtures to said washing fluid leaving said filtering unit [(50)] before its readmission into said washing apparatus [(1)].

21. (Once Amended) A method according to Claim 14, characterized in that at least one fraction of said washing fluid is readmitted in counter-current with respect to the flow of said scales in a device [(35)] for withdrawing said scales from said washing apparatus.

22. (Once Amended) A method according to Claim 14, characterized by maintaining a quantity of said washing fluid in said washing apparatus [(1)] that is proportional to the quantity of scales present at that same moment in said washing apparatus [(1)].

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## APPENDIX II

## CLEAN VERSION OF AMENDED CLAIMS (37 CFR 1.121)

CLAIMS

1. A plant for the continuous washing of plastic material in scales, of the type comprising a washing apparatus equipped with at least one rotating stirrer and containing a washing fluid, at least one filtering unit connected to said apparatus for purifying said washing fluid, a device for feeding said scales to said washing apparatus, a device for withdrawing said scales from said washing apparatus and a plurality of conduits to connect in fluid communication said washing apparatus and said filtering unit with a circuit in which said washing fluid flows, including means for varying the time said scales remain in said washing apparatus as a function of the quantity of scales contained at the same moment in said washing apparatus.
2. A plant according to Claim 1, wherein said rotating stirrer, said device for feeding said scales and said device for withdrawing said scales are operated by respective electric motors.
3. A plant according to Claim 1 wherein said means for varying the time said scales remain in said washing apparatus comprises at least one first control device acting to receive as input a data item representative of the current drawn by the motor driving said stirrer and to control the driving of said motors connected respectively to said device for feeding said scales and to said device for withdrawing said scales.
4. A plant according to Claim 1, additionally comprising at least one second control unit for varying the speed of rotation of said stirrer as a function of the quantity of scales contained in said washing apparatus.
5. A plant according to Claim 1 wherein said washing apparatus comprises a closed container and is surrounded by a heat-insulating covering shell to form a gap between an inside wall of said shell and an external wall of said container.
6. A plant according to Claim 5, additionally comprising means for making a heating fluid to circulate in said gap.

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7. A plant according to Claim 1 wherein said washing fluid consists of an aqueous solution.
8. A plant according to Claim 1 additionally comprising a conduit of readmission that carries at least one fraction of the washing fluid purified by said at least one filtering unit to said device for withdrawing said scales from said washing apparatus, the remaining fraction of said fluid being reintroduced directly into said washing apparatus.
9. A plant according to Claim 8, additionally comprising at least one heat exchanger device located along said conduit of readmission to control the temperature of said washing fluid by means of a heating fluid.
10. A plant according to Claim 8, additionally comprising at least one device located along said conduit of readmission for monitoring the pH of said washing fluid.
11. A plant according to Claim 8, additionally comprising at least one station located along said conduit of readmission for adding one or more chemical products to the aqueous solution that constitutes said washing fluid.
12. A plant according to Claim 6 wherein said heating fluid introduced into said gap and in said heat exchanger device consists of high temperature steam.

13. A plant according to Claim 1 wherein said at least one filtering unit comprises at least one fine-pore filtering element.

14. Method for washing plastic material in scales, of the type providing the feeding and the withdrawing of said scales in a continuous way to a washing apparatus equipped with at least one rotating stirrer and containing a washing fluid, characterized by providing the regulation of the time said scales remain in said washing apparatus as a function of the quantity of scales contained at that same moment in said washing apparatus.

15. A method according to Claim 14, characterized in that the time said scales remain in said apparatus is regulated by acting on the quantity of scales fed to said washing apparatus and on the quantity of scales withdrawn from said washing apparatus.

16. A method according to Claim 14, characterized by further providing the regulation of the speed of rotation of said stirrer as a function of the quantity of scales contained at that same moment in said washing apparatus.

17. A method according to Claim 14, characterized in that said washing apparatus comprises a substantially closed container in which said washing fluid and said scales are maintained at a substantially constant temperature by means of a heating fluid that circulates in contact with an external surface of said container.

18. A method according to Claim 14, characterized by providing for the purification of said washing fluid by means of a filtering unit comprising at least one fine-pore filtering element.

19. A method according to Claim 14, characterized by providing for the control of the temperature of said washing fluid leaving said filtering unit before its readmission into said washing apparatus.

20. A method according to Claim 14, characterized by providing for the control of the pH of said washing fluid and the addition of chemical mixtures to said washing fluid leaving said filtering unit before its readmission into said washing apparatus.
21. A method according to Claim 14, characterized in that at least one fraction of said washing fluid is readmitted in counter-current with respect to the flow of said scales in a device for withdrawing said scales from said washing apparatus.
22. A method according to Claim 14, characterized by maintaining a quantity of said washing fluid in said washing apparatus that is proportional to the quantity of scales present at that same moment in said washing apparatus.

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"PLANT FOR WASHING PLASTIC MATERIAL "Field of the Invention

The present invention relates to a plant for washing plastic material in scales, in particular a plant of the type destined to be inserted in  
5 a line for the treatment of recyclable plastic materials.

State of the Art

The products in plastic material containing one or more recyclable parts are conveyed to the recycling plants and subjected to different treatments to separate the recyclable parts and make  
10 them fit for subsequent reuse.

A particular example of recyclable plastic material is the polyethylene terephthalate (PET) of which the bottles containing mineral waters, drinks or similar are generally made.

In order to effectively obtain recyclable PET from these bottles, all  
15 those parts joined to the bottle but made with other materials, for instance the labels in paper or plastic, the glue used to stick them to the bottle, as well as the stopper and the base of the bottle, generally made of polyolefin or similar, must be eliminated.

The processes till now proposed in the known technique, comprising  
20 different phases of washing and separation of the materials, haven't given satisfactory results till now because both the purity of the recyclable material so obtained and the costs necessary to get a product of high purity. These drawbacks are mainly due to the need to reconcile two clearly conflicting demands.

25 On one hand, the washing treatment must be sufficiently energetic and extended in time to allow the separation of the glue fixing the labels. Furthermore, the continuous removal of the glue and the residues of labels from the washing fluid must be guaranteed.

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On the other, the costs necessary to satisfy these requirements are particularly high, because of the considerable quantity of washing fluid necessary to remove the glue, and because of the long time required by the treatment. Furthermore, it must be remembered that  
5 it is necessary bring the glue to the melting temperature, to allow the same to melt and to mix with the washing fluid. That requires a high waste of energy, and therefore causes very high costs, if it is desired to obtain recyclable PET of high purity.

#### Purposes of the invention

10 The purpose of the present invention is therefore to propose a plant for washing recyclable plastic material in a continuous way that allows the washing of the plastic material, preferably reduced to scales, to be effected in a particular efficient way:

Another purpose of the present invention is to propose a plant of the  
15 type specified above, that allows the washing of recyclable plastic material to be effected with particular limited costs.

A further purpose of the present invention is to propose a method for washing the recyclable plastic material in a continuous way that allows recyclable plastic material of high purity to be obtained.

#### 20 Summary of the invention

These purposes are achieved by the present invention, which relates to a plant for the continuous washing of plastic material in scales, of the type comprising a washing apparatus equipped with at least one rotating stirrer and containing a washing fluid, at least  
25 one filtering unit connected to the apparatus for purifying the washing fluid, a device for feeding the scales to the washing apparatus, a device for withdrawing the scales from the washing apparatus and a plurality of conduits for connecting the washing

apparatus and the filtering unit in fluid communication with a circuit in which the washing fluid flows, characterised by comprising means for varying the time in which the scales remain in the washing apparatus as a function of the quantity of scales contained  
5 at that same moment in the apparatus.

In this way it is possible to hold the scales in the washing apparatus only for the time necessary to remove all the glue from the scales, thus allowing a considerable limitation of the washing fluid employed during the treatment. The washing fluid is constituted for  
10 instance by an aqueous solution maintained at a sufficiently high temperature to melt the glue present on the scales.

The means for varying the time in which the scales remain in the washing apparatus comprise at least a first control device that receives in input a data item representative of the current drawn by  
15 the motor driving the stirrer and controls the operation of the motors connected to the device for feeding the scales and the device for withdrawing the scales respectively. The devices for feeding and withdrawing the scales could be constituted for instance by tilted screw conveyors operated by respective electric motors.

20 A second control device allows the speed of rotation of the stirrer to be varied as a function of the quantity of scales present at that same moment in the apparatus. That allows advantageously to adapt the frictional action between the scales imparted by the stirrer as a function of their quantity present at a certain instant in the  
25 apparatus.

According to a preferential embodiment of the present invention, the washing apparatus is constituted by a closed container that is

surrounded by a heat-insulating shell to form a gap between the inside wall of the shell and the external wall of the container.

A heating fluid, for instance high temperature steam, is advantageously introduced into the gap to maintain the inside the  
5 apparatus at a constant temperature sufficient to cause the melting of the glue on the scales subjected to treatment and prevent the same glue from solidifying and being deposited again on the scales.

The washing fluid withdrawn from the apparatus is conducted to a  
10 filtering unit in which is separated, not only the papery residues still present, but also the glue which is deposited on a fine-pore filtering element. The latter is preferably constituted by a fossil meal filter from which the layer of glue that sticks there is continually removed.

The washing fluid as purified is reintroduced by means of a conduit  
15 of readmission which carries at least a fraction of the purified washing fluid to the device for withdrawing the scales from the washing apparatus. The purified fluid coming out from the filtering unit, which is undoubtedly cleaner than the washing fluid dragged together with the scales leaving the washing apparatus, is  
20 advantageously used to rinse the scales before these go on to a subsequent stage. That makes it possible therefore to bring impurities still present on the scales back into the apparatus again. This not only reduces the quantity of washing fluid employed, but also improves the purity of the material leaving the apparatus.

25 There is preferably a heat-exchanger provided along the readmission conduit that permits the fluid to be brought up to the desired temperature again before the reintroduction in the washing apparatus, as well as one or more stations to monitor and, if

necessary, correct the pH and the composition of the reintroduced fluid.

The invention further concerns a method for washing plastic material in scales, of the type providing the feeding and the withdrawing in a continuous way of scales in a washing apparatus equipped with at least one rotating stirrer and containing a washing fluid, characterised by providing for the regulation of the time the scales remain in the apparatus as a function of the quantity of scales contained at that same moment in the same apparatus.

- 10 A particularly advantageous aspect of the method according to the invention consists in maintaining a quantity of washing fluid in the washing apparatus that is proportional to the quantity of scales present at that same moment in the apparatus. This allows that only a quantity of fluid effectively necessary to each instant of the washing phase be used, thus allowing to further limit the consumption of the washing fluid employed.

Furthermore, the method according to the invention, provides the regulation of the speed of rotation of the stirrer as a function of the quantity of scales contained at that same moment in said apparatus, thus allowing the frictional action between the scales to be varied as a function of the actual quantity of scales subjected to washing in any determined instant.

#### Brief Description of the Drawings

Further advantages and characteristics of the present invention will be more evident from the description that follows, made by way of example and with not limiting purpose, with particular reference to the attached drawing, in which a schematic view of a plant according to the present invention is illustrated.

### Modes for Carrying Out the Invention

The figure represents a plant for the continuous washing of plastic material in scales and, in particular, of scales made of recyclable PET. The plant in particular comprises a washing apparatus 1  
5 equipped with an stirrer 2 set in rotation by an electric motor 3, with a plurality of vanes 4 that impart an action of agitation to both a washing fluid, consisting preferably of an aqueous solution, and the scales of plastic material present in the apparatus 1.

The plastic material in scales arrives at the apparatus 1, represented  
10 symbolically by the  $P_{IN}$  arrow, and is introduced into the washing apparatus 1 by means of a tilted screw conveyor 5 driven by an electric motor 6. The scales introduced into the apparatus 1 generally transport also a small fraction of a fluid, also consisting of an aqueous solution used in upstream processing stages, for  
15 instance a floatation bath to separate PET (heavier than water) from polyolefin or similar (lighter than water).

Inside the washing apparatus 1 the scales are subjected to the action of agitation imparted by the stirrer 2 in the presence of the washing fluid maintained at a constant temperature preset in the  
20 interval between 85 °C and 100 °C, preferably around 95 °C. The stirrer energetic action causes mutual friction between the scales and the simultaneous action of the washing fluid at preset temperature causes the glue to separate from the scales and become suspended in the washing fluid.

25 To prevent the glue solidifying again and being re-deposited on the same scales, it is particularly important to maintain a constant temperature inside the apparatus. For this reason, the washing apparatus 1 is made of a closed container 10 completely

surrounded by a covering of heat-insulating shell 11. Between the external wall of the container 10 and the inside wall of the shell 11 there is a gap 12 in which high-temperature steam is caused to circulate in order to maintain substantially constant the temperature inside the washing apparatus 1.

The flow of scales inside the washing apparatus 1, and therefore the time they remain in the apparatus, is controlled on the basis of the quantity of scales present at that same moment in the washing apparatus. That is done by measuring the instantaneous current drawn by the motor 3 driving the stirrer 2. The signal representative of this parameter is sent to a control unit 20 that consequently controls the motor 6 of the screw conveyor 5 introducing the scales and the motor 36 of the screw conveyor 35 withdrawing the scales. Inverter devices are connected to both the electric motors 6 and 36 respectively which allow the speed of the screw conveyors to be regulated.

A further control is effected on the rotation speed of the motor 3, and therefore on the stirring action inside the washing apparatus 1, always as a function of the quantity of scales present at that same moment in the apparatus 1. This control could be effected by the same unit 20, as represented in the figure or, if necessary, by a separate control unit that acts on an inverter device connected to the electric motor 3.

These controls allow the parameters that determine effective washing of the scales, i.e. the stay time and the amount of agitation, to be adapted advantageously on the basis of the quantity of scales present in the apparatus in any determined instant. With continuous washing, the quality of the product output

by the plant according to the present invention can be maintained constant.

It is important to point out that the quantity of washing fluid present in the washing apparatus 1 during normal operation is always maintained substantially proportional to the quantity of scales present at that same moment in the apparatus. That is achieved by regulating the quantity of washing fluid that is readmitted to the apparatus as a function of the quantity of fluid expelled from the filtering unit 50 that is described below in more detail.

- 10 The scales leaving the apparatus (indicated schematically by the P<sub>OUT</sub> arrow) are withdrawn by the screw conveyor 35 at the extremity opposite that of introduction and are sent to the next processing stage, for instance a scale rinsing and/or drying and/or desiccation stage. There is a perforated grate 15 provided in correspondence with the collecting extremity that allows the collection of the washing fluid to be purified and sends it to a particular filtering unit 50 that allows the removal of the glue from the washing fluid.

- The washing fluid removed from the apparatus 1 is sent by means of a conduit 16 to a heat exchanger 17 that provides for the lowering of the temperature of the fluid by means of circulation of cooling water. A pump 18 located along a conduit 19 allows to transfer the washing fluid from the heat exchanger 17 to the filtering unit 50. The latter comprises a filtering element 51, of the fine-pore type, partially immersed in a bath 52. The filtering element 51 comprises preferably a drum made of fossil meal on which is continually deposited, and from which is continually removed, the glue mixed with the washing fluid.

Since the temperature of the fluid in the filtering unit 50 is lower than the melting point of the glue, the latter is deposited on the external surface of the filtering element 51 and is continually removed, if necessary together with a thin layer of the filtering element 51, by a blade 53 and expelled through a waste S2.

The washing fluid thus purified is regenerated in its essential characteristics before being reintroduced into the washing apparatus 1. In particular, the fluid is withdrawn from the filtering unit 50 by means of a pump 60 and sent toward a reservoir 70, in which a heat exchanger 80 raises the temperature by means of steam ( $V_{IN}$  arrows and  $V_{OUT}$ ). Fresh water (arrow  $H_2O$ ) is introduced into the reservoir 70 to compensate the loss of fluid in the filtering unit 50 and to make up the circulating volume.

The fluid driven by a pump 90 is restored in a control station 100 by a possible correction of the pH by means of admission of suitable additives (PH arrow), as well as in a control station 110 in correspondence of which suitable chemical additives (T arrow) such as surfactants or similar substances, for instance, are added.

A conduit 91 then carries the fluid toward a junction 92 from which one conduit 93 brings the purified fluid again directly into the washing apparatus 1. A part of the purified fluid is advantageously conveyed in another conduit 94, also connected to the junction 92, and introduced in the screw conveyor 35 to carry out an effective rinsing of the scales in counter-current. Both the conduits 93 and 94 are preferably equipped with respective valves 95 and 96 to allow the independent regulation of the fractions of liquid reintroduced into the apparatus 1 and in the screw conveyor 35.

Preferably, the quantity of washing fluid of introduced initially into the apparatus is proportional to what is presumed to be the ideal quantity for effective washing. It has been established that, during the normal operation, the quantity of washing fluid present at that  
5 same moment in the apparatus 1 tends, however, to stay substantially proportional to the quantity of scales present inside the washing apparatus 1 in the same instant. This is due to the fact that the scales, as much in entry as in exit, carry in each case some fluid adhering to them.

10 Therefore, the only regulation necessary to maintain the desired optimal proportion between quantity of scales and quantity of the washing fluid is effected by acting simply on the pump 90 and on the admission of fresh water in correspondence of the reservoir 70. That not only allows limiting the quantity of fluid used by the plant,  
15 but also means always having optimum conditions inside the apparatus 1 to get effective continuous washing treatment, independently of the variation of flow of scales upstream and/or downstream of the plant according to the present invention.

## CLAIMS

1. A plant for the continuous washing of plastic material in scales, of the type comprising a washing apparatus (1) equipped with at least one rotating stirrer (2) and containing a washing fluid, at least one filtering unit  
5 (50) connected to said apparatus for purifying said washing fluid, a device (5) for feeding said scales to said washing apparatus (1), a device (35) for withdrawing said scales from said washing apparatus (1) and a plurality of conduits to connect in fluid communication said washing apparatus (1) and said filtering unit (50) with a circuit in which said washing fluid flows,  
10 characterized by comprising means (20, 6, 36) for continuously varying the time said scales remain in said washing apparatus (1) as a function of the quantity of scales contained at the same moment in said washing apparatus.
2. A plant according to Claim 1, characterized in that said rotating stirrer  
15 (2), said device (5) for feeding said scales and said device (35) for withdrawing said scales are operated by respective electric motors (6, 36).
3. A plant according to Claim 1 or 2, characterized in that said means for varying the time said scales remain in said washing apparatus (1) comprises at least one first control device (20) acting to receive as input a  
20 data item representative of the current drawn by the motor (3) driving said stirrer (2) and to control the driving of said motors (6, 36) connected respectively to said device (5) for feeding said scales and to said device (35) for withdrawing said scales.
4. A plant according to Claim 1, characterized by comprising at least  
25 one second control unit for varying the speed of rotation of said stirrer (2) as a function of the quantity of scales contained in said washing apparatus (1).
5. A plant according to any of the preceding Claims, characterized in that said washing apparatus (1) comprises a closed container (10) and is

surrounded by a heat-insulating covering shell (11) to form a gap (12) between the inside wall of said shell (11) and the external wall of said container (10).

5 6. A plant according to Claim 5, characterized by comprising means for making a heating fluid to circulate in said gap.

7. A plant according to any of the preceding Claims, characterized in that said washing fluid consists of an aqueous solution.

8. A plant according to any of the preceding Claims, characterized by comprising a conduit of readmission (94) that carries at least one fraction  
10 of the washing fluid purified by said at least one filtering unit (50) to said device (35) for withdrawing said scales from said washing apparatus (1), the remaining fraction of said fluid being reintroduced directly into said washing apparatus (1).

9. A plant according to Claim 8, characterized by comprising at least  
15 one heat exchanger device (17) located along said conduit of readmission (16, 19, 91, 93, 94) to control the temperature of said washing fluid by means of a heating fluid.

10. A plant according to Claim 8, characterized by comprising at least one device (100) located along said conduit of readmission (16, 19, 91,  
20 93, 94) for monitoring the pH of said washing fluid.

11. A plant according to Claim 8, characterized by comprising at least one station (110) located along said conduit of readmission (16, 19, 91, 93, 94) for adding one or more chemical products to the aqueous solution that constitutes said washing fluid.

25 12. A plant according to Claim 6 or 9, characterized in that said heating fluid introduced into said gap (12) and in said heat exchanger device (17) consists of high temperature steam.

13. A plant according to any of the preceding Claims, characterized in that said at least one filtering unit (50) comprises at least one fine-pore filtering element (51).

14. A method for washing plastic material in scales, of the type providing  
5 the feeding and the withdrawing of said scales in a continuous way to a washing apparatus (1) equipped with at least one rotating stirrer (2) and containing a washing fluid, characterized by providing the continuous regulation of the time said scales remain in said washing apparatus (1) as a function of the quantity of scales contained at the same moment in said  
10 washing apparatus (1).

15. A method according to Claim 14, characterized in that the time said scales remain in said apparatus is regulated by acting on the quantity of scales fed to said washing apparatus (1) and on the quantity of scales withdrawn from said washing apparatus (1).

16. A method according to Claim 14, characterized by further providing  
15 the regulation of the speed of rotation of said stirrer (2) as a function of the quantity of scales contained at that same moment in said apparatus.

17. A method according to Claim 14, characterized in that said washing  
apparatus (1) comprises a substantially closed container (11) in which  
20 said washing fluid and said scales are maintained at a substantially constant temperature by means of a heating fluid that circulates in contact with the external surface of said container (11).

18. A method according to Claim 14, characterized by providing for the purification of said washing fluid by means of a filtering unit (50)  
25 comprising at least one fine-pore filtering element (51).

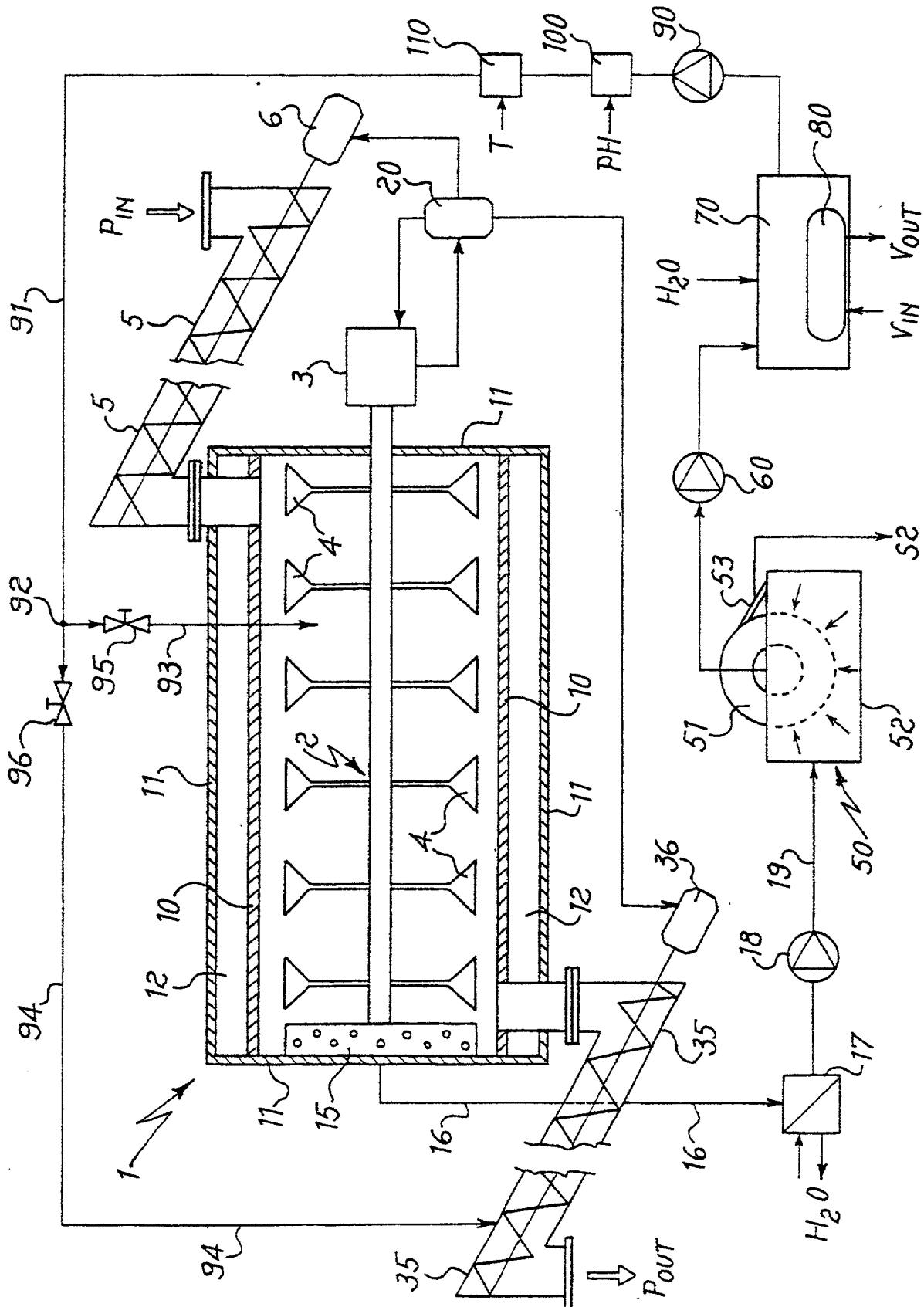
19. A method according to Claim 14, characterized by providing for the control of the temperature of said washing fluid leaving said filtering unit (50) before its readmission into said washing apparatus (1).

20. A method according to Claim 14, characterized by providing for the control of the pH of said washing fluid and the addition of chemical mixtures to said washing fluid leaving said filtering unit (50) before its readmission into said washing apparatus (1).

5 21. A method according to Claim 14, characterized in that at least one fraction of said washing fluid is readmitted in counter-current with respect to the flow of said scales in a device (35) for withdrawing said scales from said apparatus.

22. A method according to Claim 14, characterized by maintaining a  
10 quantity of said washing fluid in said apparatus (1) that is proportional to the quantity of scales present at that same moment in said washing apparatus (1).

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## DECLARATION FOR PATENT APPLICATION

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name. I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **Plant For Washing Plastic Material**, the specification of which is attached hereto. I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PCT/IT99/00173 ✓

Italy ✓

16 June 1999 ✓

Yes

Number

Country

Day/Month/Year Filed

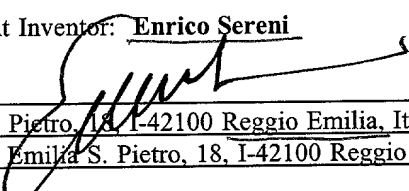
Priority Claimed

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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PATENT  
Attorney Docket No.: MARIETTI-06724

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: **Piergiorgio Terruggi et al**  
Serial No.:  
Filed:  
Entitled: **Plant For Washing Plastic Material**

Group No.:  
Examiner:

POWER OF ATTORNEY BY ASSIGNEE

Assistant Commissioner for Patents  
Washington, D.C. 20231

Amat S.p.A., as Assignee of record of the entire interest of the above-identified patent application, hereby appoints the members of the firm of MEDLEN & CARROLL, LLP, a firm composed of:

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I hereby certify that the Assignment document filed with the application or filed subsequent to the filing date of the application, has been reviewed and I hereby certify that, to the best of my knowledge and belief, this is with Amat S.p.A.

Dated: December 11, 2001

By: x *Elio Facchetti*

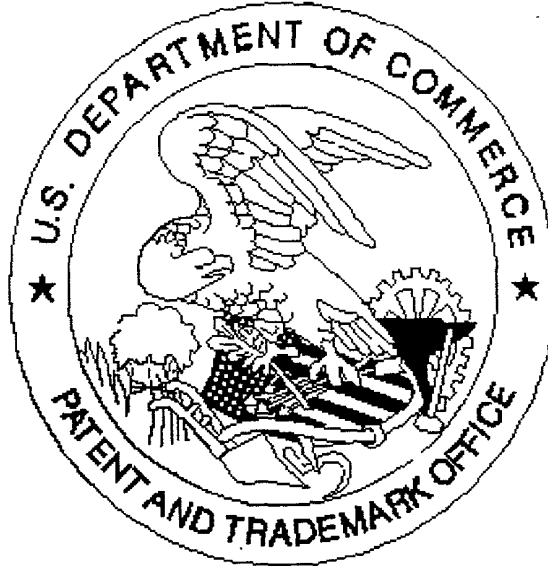
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